Amendments to the Claims

1. (Currently amended) A process for etching an oxide layer in the presence of a nitride layer, wherein said oxide layer is preformed with holes extending downwardly from a top surface thereof and corners of said oxide layer at tops of said holes are exposed during the process, said process comprising the steps of:

flowing into a plasma reaction chamber a gas mixture comprising a first amount of hexafluorobutadiene and a second amount of xenon ~~a chemically inactive diluent gas~~ and including substantially no carbon monoxide, wherein a ratio of said second amount to said first amount is at least one;

applying a first level of RF power to a pedestal electrode supporting a substrate containing said oxide and nitride layers; and

exciting said gas mixture into a plasma to thereby selectively etch said oxide layer to said nitride layer.

2. (Previously presented) The process of Claim 1, wherein said oxide layer overlies said nitride layer and said ratio is at least ten, to thereby etch said oxide layer selectively to said nitride layer.

3 – 11. (Canceled)

12. (Original) The process of Claim 1, wherein said exciting step includes applying an oscillatory electrical signal to excite said gas mixture into a plasma in a region remote from said pedestal electrode.

13. (Original) The process of Claim 12, wherein said oscillatory electrical signal is coupled to an inductive coil adjacent to said chamber.

14. (Previously presented) The process of Claim 12, wherein said applying steps applies at least 1600W to said pedestal electrode normalized to a 200mm wafer.

16. (Original) The process of Claim 1, wherein processing conditions are chosen to produce a processing window of 25% in the amount of the ~~fluorine-containing gas~~ hexafluorobutadiene.

17 – 20. (Canceled)

21. (Previously presented) A process for etching an oxide layer preformed with first holes extending downwardly from a top surface thereof, comprising the steps of:

flowing into a plasma reaction chamber a gas mixture comprising a first amount of a fluorine-containing gas and a second amount of a chemically inactive diluent gas, wherein a ratio of said second amount to said first amount is at least one;

applying a first level of RF power to a pedestal electrode supporting a substrate containing said oxide layer; and

exciting said gas mixture into a plasma to etch said oxide layer, wherein corners of said oxide layer at tops of said first holes are exposed during the process and wherein said exciting step etches said oxide layer for only a predetermined length of time to etch only partially through said oxide layer from said top surface.

22. (Previously presented) The process of Claim 21 carried out in the presence of a nitride layer, wherein said plasma etches said oxide layer selectively to said nitride layer.

23. (Previously presented) The process of Claim 22, wherein said oxide layer overlies said nitride layer.

24. (Previously presented) The process of Claim 21, wherein said fluorine-containing

gas comprises a fluorocarbon.

25. (Previously presented) The process of Claim 24, wherein said fluorocarbon consists of at least four carbon atoms, at least an equal number of fluorine atoms, and no more than two hydrogen atoms.

26. (Previously presented) The process of Claim 24, wherein said fluorocarbon is hydrogen free.

27. (Previously presented) The process of Claim 25, wherein said fluorocarbon is selected from the group consisting of C_4F_6, C_5F_8, and C_6F_6.

28. (Previously presented) The process of Claim 27, wherein said fluorocarbon comprises hexafluorobutadiene.

29. (Previously presented) The process of Claim 28, wherein said oxide layer overlies a nitride layer and said plasma etches said oxide layer selectively to said nitride layer.

30. (Previously presented) The process of Claim 1, wherein said chemically inactive diluent gas is xenon.

31. (Canceled)

32. (Previously presented) The process of Claim 21, wherein said chemically inactive diluent gas is xenon.

33. (Previously presented) The process of Claim 21, wherein said chemically inactive diluent gas is argon.

34. (Presently amended) ~~The process of Claim 27, wherein said fluorocarbon comprises~~ A process for etching an oxide layer preformed with first holes extending downwardly from a top surface thereof, comprising the steps of:

flowing into a plasma reaction chamber a gas mixture comprising a first amount of C_5F_8 and a second amount of a chemically inactive diluent gas, wherein a ratio of said second amount to said first amount is at least one;

applying a first level of RF power to a pedestal electrode supporting a substrate containing said oxide layer; and

exciting said gas mixture into a plasma to etch said oxide layer, wherein corners of said oxide layer at tops of said first holes are exposed during the process and wherein said exciting step etches said oxide layer for only a predetermined length of time to etch only partially through said oxide layer from said top surface.

35. (Previously presented) The process of Claim 21, wherein said oxide layer is precoated with an etching mask having an aperture larger than and surrounding at least one of said first holes.

36. (Previously presented) The process of Claim 21,

wherein said exciting step etches second holes in said oxide layer, and

wherein said first holes form via holes and said second holes form trenches in a dual damascene interconnect system.

37. (Previously presented) A dual damascene process for etching an oxide layer preformed with first holes extending downwardly from a top surface thereof and covered by a mask layer including a second hole therethrough larger than and surrounding at least one of said first holes, comprising the steps of:

flowing into a plasma reaction chamber a gas mixture comprising (a) a fluorocarbon

selected from the group consisting of C_4F_6, C_5F_8, and C_6F_6 and (b) a chemically inactive diluent gas; and

applying RF power to a pedestal electrode supporting a substrate containing said oxide layer and exciting said gas mixture into a plasma to etch said oxide layer, wherein corners of said oxide layer at tops of said first holes are exposed during the process.

38. (Previously presented) The process of Claim 37, wherein a portion of a top surface of said oxide layer is exposed by said second hole.

39. (Previously presented) The process of Claim 37, wherein a nitride layer is disposed below said oxide layer and is exposed by said first holes.

40. (Previously presented) The process of Claim 39, wherein no other nitride layer is disposed between a top surface of said oxide layer and said nitride layer.

41. (Previously presented) The process of Claim 37, wherein said fluorocarbon comprises hexafluorobutadiene.

42. (Presently amended) ~~The process of Claim 37, wherein said fluorocarbon comprises~~ A dual damascene process for etching an oxide layer preformed with first holes extending downwardly from a top surface thereof and covered by a mask layer including a second hole therethrough larger than and surrounding at least one of said first holes, comprising the steps of:

flowing into a plasma reaction chamber a gas mixture comprising (a) C_5F_8 and (b) a chemically inactive diluent gas; and

applying RF power to a pedestal electrode supporting a substrate containing said oxide layer and exciting said gas mixture into a plasma to etch said oxide layer, wherein corners of said oxide layer at tops of said first holes are exposed during the process.

43. (Previously presented) The process of Claim 37, wherein a separate source of oscillatory electrical power excites said gas mixture to said plasma.

44. (Previously presented) The process of Claim 37, wherein said RF power applied to said pedestal electrode excites said gas mixture to said plasma, no other effective source of oscillatory electrical power being applied to said plasma reaction chamber.

45. (Previously presented) The process of Claim 37, wherein said applying and exciting step is terminated before portions of said oxide layer exposed by said second hole are etched through.

Remarks

Claims 1, 2, 12-16, 21-30, and 32-45 remain in the application.

The Examiner has rejected Claims 1, 2, 12-14, 16, 21-29, 31, 33, 35-41, and 43-45 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 6,174,4115, hereafter Hung. The xenon restriction of Claim 30 has been incorporated into Claim 1 so that Claims 1, 2, 12-14, and 43-45 should be allowed.

The rejection of Claim 21 and its dependent claims is traversed. Claim 21 requires both that upper corners of the preformed hole be exposed during the etch and that the etch proceed only partially through the oxide layer. Hung shows only a SAC etch with a single masking step. Hung does not disclose exposed oxide corners during the etch. Furthermore, Hung completely etches through the oxide layer18 before stopping on the underlying nitride layer 14 (col. 2, ll. 28-29). While Hung may divide the oxide etch into a main etch and an over etch, as he explains at col. 8, ll. 58-60, the main etch is intended to reach the nitride stop layer in most contact holes, and the oxide etch as a whole etches completely through the oxide layer. Hung describes some alternative etch structures at col. 11, ll. 11-38, but it is not seen that any of these conform to the claimed requirements. For the part of the rejection concerning the exposed oxide corners, the Examiner references U.S. Patent 6,211,092 to Tang et al., hereafter Tang. However, this amounts to a combination rejection under 35 U.S.C. §103, not an anticipation rejection, for which a single reference must show each and every feature being claimed. In a combination rejection, as stated in 35 U.S.C. §103(c), neither Hung nor Tang are available as references under §102(e) since they are commonly owned. Tang is separately distinguished below.

The rejection of Claim 37 and its dependent claims is traversed. Claim 37 requires that the oxide layer be preformed with first holes at least one of which is surrounded by a mask layer having a larger aperture and that corners of the oxide layer are exposed during etching. Hung shows only the SAC etch structure having no preformed hole surrounded by a mask layer with a larger aperture. Further, the oxide layer does not have exposed corners during the etch. As

stated above, Tang is not available as a reference in combination with Hung.

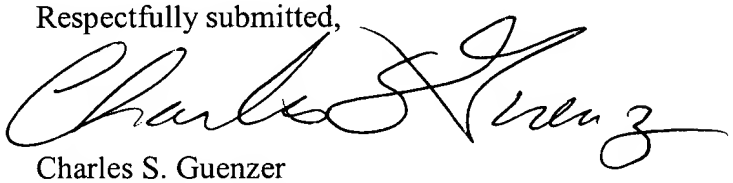
The Examiner has rejected Claims 21-27, 33, 35, and 36 under 35 U.S.C. §102(e) as being anticipated by Tang. The Examiner references FIGS. 5 and 6. This rejection is traversed. Tang shows in FIG. 5 that the hole 50 is preformed in the upper oxide layer 20 (as well as the lower oxide layer 14 and the intervening nitride layer 16) and has exposed upper corners in the upper oxide layer. However, as shown in FIG. 6, the etch continues through the upper oxide layer 20 before stopping on the nitride layer 16 (col. 4, ll. 25-28). While Tang shows in FIG. 11 an etch continuing only part way through the lower oxide layer 14, there are no exposed upper corners, as required by the claims. Thus Tang fails to teach continuing the etch for a predetermined length of time to only partially through the upper oxide layer in the presence of exposed oxide corners. Indeed, her underlying nitride layer 16 is used to assure that the upper oxide layer is completely etched through during an over-etch period. Accordingly, Tang does not anticipate Claim 21.

The Examiner indicates that Claims 30, 32, 34, and 42 would be allowable if rewritten in independent form. Claim 30 has been incorporated into Claim 1. Claim 32 depends upon a claim believed to be allowable. Claims 34 and 42 have been rewritten in independent form.

In view of the above amendments and remarks, reconsideration and allowance of all claims are respectfully requested. If the Examiner believes that a telephone interview would be helpful, he is invited to contact the undersigned attorney at the listed telephone number, which is on California time.

Date: 30 October 2003

Respectfully submitted,



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